THE SURPRISING INTERACTIVE EFFECT OF RACE AND HIGH POVERTY ON FOOD INSECURITY

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Abstract

Existing research has identified multiple factors contributing to food insecurity in the United States – notably, among others, race and poverty. However, it is unknown how these factors interact to create variations in food insecurity by demographic. Using data from the 2018 Current Population Survey's Food Security Supplement in probit regression, this analysis finds that race and poverty significantly interact. Further, the direction of the interaction runs counter to expectation. Although, as expected, minorities remain at a higher risk of food insecurity than (non-Hispanic) Whites do overall, for minorities the interaction is associated with *lowering* the probability of food insecurity by 0.74% and for Whites the interaction is associated with *increasing* the probability by 0.21%. This surprising finding potentially impacts hundreds of thousands of people. It also carries important implications for food-aid programs and opens up avenues for further research to understand the impact of race and culture on food insecurity.

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1. Introduction

In 2018, about 37.2 million Americans – many of them children – were food insecure.[1] This means that roughly 11% of Americans did not have enough food to eat at times.[2] The concept of food insecurity is defined by the U.S. Department of Agriculture (USDA) as the extent to which individuals are sometimes "unable to acquire adequate food [because of] insufficient money and other resources for food".[1]

Food insecurity is of both moral and political importance. It is a morally compelling issue that stirs compassion into action from researchers, policy makers, and everyday citizens to alleviate the painful reality of hunger. It is also a politically significant issue, in part, because society cannot function optimally if millions of its members cannot meet basic needs of life. Various studies have found an association between food insecurity and domestic[3] or political[4] violence as well. However, food

[1] Coleman-Jensen, Alisha, Matthew P. Rabbitt, Christian A. Gregory, and Anita Singh. 2019. Household Food Security in the United States in 2018, ERR-270, U.S. Department of Agriculture, Economic Research Service.

[2] In 2018, 11% of U.S. households were food insecure, with 4.3% classified as very-low-food-secure. The USDA classifies food insecurity as either low-food-security or very-low-food-security. Low food security occurs when a household has difficulty acquiring food but very few, if any, instances of not having enough to eat. Very low food security occurs when a household not only has difficulty acquiring food but also gives multiple indications of actually not having enough to eat due to a lack of resources. Very-low-food-secure households are characterized by experiences such as: worrying that food will run out before they have money to buy more, buying food but not having it last until the next paycheck, not having enough to afford balanced meals, cutting food portions to save for subsequent meals, and going hungry. The categories of low-food-security and very-low-food-security can be combined, as they are in this paper, into one category to be collectively labeled as "food-insecurity".

[3] Dylan B. Jackson, Kellie R. Lynch, Jesse J. Helton and Michael G. Vaughn. "Food Insecurity and Violence in the Home: Investigating Exposure to Violence and Victimization among Preschool-Aged Children." *Health Education & Behavior* 45, no. 5 (2018): Page 756.

[4] Jones, Benjamin T., Eleonora Mattiacci, and Bear F. Braumoeller. "Food scarcity and state vulnerability: Unpacking the link between climate variability and violent unrest." *Journal of Peace Research* 54, no. 3 (2017): 335-350.

insecurity is not a uniform occurrence as it varies sizably along demographic and geographic lines.[5,8] Since food insecurity differs greatly by demographic, it is important for policy makers and researchers to understand why and how such variation occurs. This information can help guide government policies in a way that will ameliorate the deeply politically-polarized environment that aches the United States today.

While much research has been done to identify downstream impacts and upstream factors of food insecurity, not much focus has been placed on how various factors interact with one another. This paper focuses on two key demographic factors of food insecurity, namely: race and high levels of poverty. Existing research literature, discussed further below, shows that each of these factors – separately – is associated with a sizably greater probability of food insecurity. This paper tests for interaction between the two variables, controlling for other relevant factors.

While generally confirming earlier findings, this paper uncovers a statistically significant interaction between race and high poverty. Further, and surprisingly, the direction of this interaction runs counter to expectation. The findings reveal that while, on the whole, non-Whites are more likely to experience food insecurity than non-Hispanic Whites, nonetheless race interacts with high poverty to slightly *reduce* the probability of food insecurity for non-Whites but slightly *increase* the probability for Whites.[6] This runs counter to the expectation that racial minorities experiencing high

[5] Intra-household variations in food insecurity also exist, such as in households with children where older siblings sometimes sacrifice their own needs to ensure that younger siblings do not go hungry or undernourished.

[6] Whites, for the purposes of this paper, are classified as non-Hispanic Whites only. All others are classified as Non-Whites.

poverty would always be in the absolute worst-case-scenario vis-a-vis food insecurity. While certain minorities are likely to be at an especially heightened risk, results suggest that race, poverty, and food insecurity have a more nuanced relationship than one would expect intuitively – and that it is worth researching further. This paper posits that the observed result potentially comes from cultural differences between minorities and Whites. As discussed further below, minority communities might have stronger communal and family bonds that activate more quickly than those for Whites do in times of need.

The following section provides an overview of existing literature on food insecurity. Then the data and methods employed for analysis are discussed. Subsequently, results are presented along with potential causal explanations and implications. The paper concludes with recommendations for further research.

2. Literature Review and Theoretical Framework

2.1. Evolving Definitions of Food Insecurity

The concept of Food Insecurity has had multiple definitions evolving with time and location.[7,8] Early definitions circa World War I centered on adequate food supply (supply-side). However, the focus shifted by the 1970s to evaluating adequate food access for households (consumer-focused). By the mid-1990s the currently-prevailing

[7] Jones, Andrew D., Francis M. Ngure, Gretel Pelto, and Sera L. Young. "What are we assessing when we measure food security? A compendium and review of current metrics." *Advances in Nutrition* 4, no. 5 (2013): 481-505.

[8] Gundersen, Craig, and James P. Ziliak. "Food insecurity research in the United States: Where we have been and where we need to go." *Applied Economic Perspectives and Policy* 40, no. 1 (2018): 119-135.

definition of food insecurity became the norm.[9] This definition considers people to be food insecure when they do not "at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy lifestyle."[7]

2.2. USDA's Definition of Food Insecurity

It is important to note the requirement of "nutritious food" above because measuring nutritive content in large government surveys is challenging. In the United States, food insecurity is measured using an annual survey administered by the USDA. In this survey, measurement of food insecurity is limited to assessing whether a household has adequate food to meet basic needs -- not necessarily nutritive enough for active, healthy living. While the USDA definition lacks identification of physiological, psychological, socioeconomic, and other aspects of food insecurity,[7] it is nonetheless widely used as the basis of current research – as it is for this paper.

2.3. Evolving Measurements of Food Insecurity

Just as multiple definitions have existed over time, so have multiple measures of food insecurity. Broadly, measures span five domains of food insecurity.[7] First, there are national-level estimates.[10] Such measures rely on food balance sheets and overall utilization analyses to account for how much food is produced, imported, exported, and

[9] This definition was adopted at the 1996 World Food Summit. The prior few decades had seen growing concerns from researchers that earlier definitions (supply-focused) lacked measurement of the actual experience of hunger and food insecurity. For instance, while there can be enough supply for a community, the lack of income or physical disability can prevent a household from actually being food secure. Food insecurity also tends to be episodic (instead of constant throughout the year) (What are we Assessing and USDA), something that earlier definitions would have likely missed.

[10] Examples of national measures include the Global Hunger Index and Global Food Security Index.

processed. However, these measures remain problematic because they fail to account for household-level experiences and variability. Second, measures exists to monitor and provide early warnings of food shortages.[11] These measures use environmental indicators such as drought levels, political instability, disease epidemics, etc. to predict possible food shortages from such shocks. Third, measures of household food access and consumption measure the extent to which households can acquire food with ease, and utilize diverse, nutritive foods.[12] Fourth, measures for participatory adaptation seek to understand how households/individuals that are experiencing food insecurity adapt to its tough realities. Such measures focus on things like reduced food intake and redistribution of foods within households.[13] Finally, measures based on direct experience seek to gather first-hand information from households via surveys. A prominent example is the aforementioned USDA annual survey. This approach identifies people's anxieties, perceptions, and food intake levels to understand the acute impact of food insecurity at the household and individual levels.

2.4. Known Factors of Food Insecurity

[11] Examples of warning measures include Famine Early Warning Systems Network (FEWS NET), the Integrated Food Security Phase Classification (IPC), and Comprehensive Food Security and Vulnerability Analyses (CFSVAs).

[12] Examples of household-level measures include a wide range of Household Consumption and Expenditure Surveys (HCESs), which include subtypes of measures. There are also Food Consumptions Scores (FCS), Household Dietary Diversity Scores (HDDS)

[13] Examples of particularly adaption measures include the Coping Strategy Index (CSI) used by the World Food Program, the Household Economy Approach (HEA) used by the Save the Children Fund

Studies have shown sizable differences in food insecurity across demographic factors. These factors include, but are not limited to: race,[8,14,15,16,17] urban or rural living,[1] composition of household,[1,8,18] income level,[1,8,19] experience or risk of homelessness,[8,19] access to food aid,[19] access to financial assets and/or credit,[8] human capital,[8] food prices,[8] ability to pay bills on time,[19] education level,[8] eating habits,[19] trait hope[20] or grit,[17] acculturation,[16] ability to manage finances,[8,17] and gender or sexual orientation.[21]

2.5. Government Solutions for Food Insecurity

Governments at multiple levels – ranging from federal to local – have instituted food aid programs or policies over time.[22] For the purposes of this paper, it suffices to briefly discuss the three main programs administered by the USDA at a federal level. First, the USDA's flagship program, called the Supplemental Nutrition Assistance

[14] McDonough, Ian K., Manan Roy, and Punarjit Roychowdhury. "Exploring the dynamics of racial food security gaps in the United States." *Review of Economics of the Household* (2019): 1-26.

[15] Assari, Shervin, and Maryam Moghani Lankarani. "Educational attainment promotes fruit and vegetable intake for whites but not blacks." *J—Multidisciplinary Scientific Journal* 1, no. 1 (2018): 29-41.

[16] Batis, Carolina, Lucia Hernandez-Barrera, Simon Barquera, Juan A. Rivera, and Barry M. Popkin. "Food acculturation drives dietary differences among Mexicans, Mexican Americans, and non-Hispanic whites." *The Journal of nutrition* 141, no. 10 (2011): 1898-1906.

[17] Nikolaus, Cassandra J., Megan Schierer, Brenna Ellison, Heather A. Eicher-Miller, Craig Gundersen, and Sharon M. Nickols-Richardson. "Grit is associated with food security among US parents and adolescents." *American journal of health behavior* 43, no. 1 (2019): 207-218.

[18] Examples include: living alone, children or working teenager present, grandparent or disabled person present, smoker present, single parent/income household etcetera.

[19] Bowen, Elizabeth A., John Lahey, Harmony Rhoades, and Benjamin F. Henwood. "Food insecurity among formerly homeless individuals living in permanent supportive housing." *American journal of public health* 109, no. 4 (2019): 614-617.

[20] Gilbert, Jonathan Ross, and Christy Ashley. "Access Granted? An Examination of Financial Capability, Trait Hope, Perceived Access, and Food Insecurity in Distressed Census Tracts." *Journal of Public Policy & Marketing* 39, no. 2 (2020): 119-134.

[21] Haskett, Mary E., Dana Kotter-Grühn, and Suman Majumder. "Prevalence and Correlates of Food Insecurity and Homelessness Among University Students." *Journal of College Student Development* 61, no. 1 (2020): 109-114.

[22] Goddeeris, Laura. "Food for Thought – How and Why Local Governments Support Local Food Systems". *Public Management*. 98, no. 11 (2016): 27-36.

Program (SNAP), was established in the 1960s and expanded in the 1970s to evolve into a nationwide program administered today.[1,8] SNAP offers subsidies for purchasing food at local retail stores. Households become eligible for SNAP if they fall under certain income and capital asset thresholds[1,7] — and the program has been shown to reduce food insecurity among participants by 5 to 20 percentage points.[8] This impact is sizable given that, as of 2018, SNAP serves over 40 million people annually in the United States.[1] Second, the National School Lunch Program (NSLP) serves free-of-cost or reduced-price meals to children from low income families. As of 2018, 29 million children across 100,000 U.S. schools received meals every school day.[1] Finally, the Special Supplemental nutrition Program for Women, Infants, and Children (WIC) is a nationwide program that offers incentives to States for providing nutritive foods to women, children, and infants. Similar to SNAP and NSLP, WIC requires plan participants to fall within defined income or risk levels. As of 2018, WIC provided food to about 7 million participants every month.[1]

2.6. Gap in Existing Research

While the aforementioned factors are known to individually influence food insecurity, it is important to understand whether – and to what degree and in which direction – some of these factors might significantly interact with each other. This can help fill the gap in understanding how food insecurity varies by demographics. For example, some studies - using parametric and non-parametric approaches - show that

racial minorities face greater rates of food insecurity than White households do.[1,23] But other studies show that negative outcomes associated with food insecurity – such as poor diet quality – sometimes impact Whites (Non-Hispanic) more than they impact certain minorities.[24] This raises the question of: if impacts of food security are not always linear, then are predictive factors of food insecurity also sometimes non-linearly related to it? Would interactions between predictive variables explain the wide variation in how food insecurity is experienced? This paper seeks to provide an answer to these questions by focusing on race and poverty as factors of food insecurity.

3. Data and Methods

Data for this analysis come from the 2018[25] release of a nationwide cross-sectional survey called the Food Security Supplement (FSS). The FSS is conducted annually by the USDA as part of the Current Population Survey (CPS) and forms the basis of USDA reports on food security. The Dec 2018 release provides "a representative sample of about 130 million U.S. households".[1] The dataset, in its raw form, contains a roster of about 146,000 surveyed individuals.[26] The unit of analysis for this paper is each individual respondent. Consistent with USDA methodology, data for this analysis are

[23] Burke, Michael P., Sonya J. Jones, Edward A. Frongillo, Maryah S. Fram, Christine E. Blake, and Darcy A. Freedman. "Severity of household food insecurity and lifetime racial discrimination among African-American households in South Carolina." *Ethnicity & health* 23, no. 3 (2018): 276-292.

[24] Leung, Cindy W., and June M. Tester. "The association between food insecurity and diet quality varies by race/ethnicity: an analysis of National Health and Nutrition Examination Survey 2011-2014 results." *Journal of the Academy of Nutrition and Dietetics* 119, no. 10 (2019): 1676-1686.

[25] Latest data available publicly at the time of this study

[26] Survey weights were not applied to the data in this analysis. The sample is large and overall estimates are well within the ballpark of official measures published in the USDA report "Household Food Security in the United States in 2018" cited earlier in this paper. Future research is suggested to conduct analysis with weights applied.

limited to about 37,300 observations in which the respondent completed the FSS questionnaire and where the household reference person responded himself/herself. This paring-down process removes non-responses and incomplete observations.

The FSS asks questions such as "*In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food? (Yes/No)".* [1] Based on answers, each respondent is classified into one of three food security categories: food secure (i.e. reported having enough to eat), low food secure (i.e. reported some instances of difficulty in attaining/consuming food), and very low food secure (i.e. reported multiple instances of difficulty in attaining/consuming food). The latter two categories are combined to determine that a respondent was food *insecure* at least once during the survey year.

This paper checks for the direction of interaction between two factors of food insecurity, namely: race and high levels of poverty ("high poverty" or "poverty" hereon). Food *Insecurity* – the dependent variable – is operationalized as a binary variable that equals 1 if the individual indicated food insecurity (i.e. not having enough to eat) and 0 if not. *Race* is a binary independent variable coded as 1 if a respondent is Non-White and 0 if White.[27] *High Poverty* is a binary independent variable coded as 1 if the respondent's household income falls below 185% of the federal Poverty Line (as of 2018). The interacted variable is binary and called *Race x High Poverty*, calculated by

[27] Race = 1 if someone is Not-White for models in Appendix 1.

multiplying the *Race* and *High Poverty* variables.[28] Table 1 shows summary statistics for the variables included in this study.

Table 1: Summary Statistics

Variable	Mean	Standard Deviation	Description	n
Food Insecurity	0.116	0.320	1 = Food Insecure, 0 = Secure	37,304
Race Non-White Y/N	0.314	0.464	1 = Non-White, 0 = White (Non-Hispanic)	37,304
High Poverty Y/N	0.291	0.454	1 = Income < 185% of Poverty Line, 0 = Unknown or Above 185%	37,304
Age	52.79	17.23	Age in years[29]	37,304
Gender – Female Y/N	0.505	0.499	1 = Female, 0 = Male	37,304
Metropolitan Area Y/N	0.795	0.404	1 = Metro Resident, 0 = Not Metro	36,958
Married Spouse Y/N	0.485	0.499	1 = Spouse Present, 0 = Not Present	37,304
Home Ownership Y/N	0.685	0.465	1 = Home Owner, 0 = Not Owner	37,304
College Degree Y/N	0.513	0.499	1 = College Graduate, 0 = Not College Graduate	37,304

Notes: *Food Insecurity* is the dependent variable. *Race*, *High Poverty* and *Race x High Poverty* are the independent variables of interest. All others are control variables.

The following relevant control variables are included from the FSS data: gender, age, whether one lives in a metropolitan area (proxy for having access to grocery stores nearby), education level (important variable on its own and also a proxy for level of human capital), marital status, and home ownership (proxy for access to equity/financial

[28] As Table 1 shows, some variables are well balanced – i.e. about equally divided – while others are not. Marital status, whether one has a college degree, and gender are about equally divided in the survey sample. However, race skews towards White respondents, home ownership skews towards those who own their homes, the poverty variables skews towards those not experiencing high poverty levels, and residence status skews towards those living in metropolitan areas. To correct for these skews, controls and robust standard errors are included in regression models in the Results section.

[29] Age is left as an ordinal categorical variable. Each category indicates count of respondents according to their age, in years. Counts of respondents in Age 80+ and Age 85+ are not aggregated. 93%+ respondents fall outside of 80+ and 85+ categories. The data is not skewed by age.

capital).[30] With the exception of *Age*, each control variable is coded as 1 if the condition in the variable name is met and 0 if not. Marital status is specifically coded as 1 only if a spouse is present. The importance of this variable is that, presumably, having a spouse present can help with acquiring, preparing and consuming food. *Age* is left as an ordered categorical variable. Probit regression is used to estimate the probability of *Food Insecurity* and to test if the coefficients on various variables – including the interacted variable – are statistically significant.

4. Results

The aim of this paper's analysis is to test if an interaction exists between race and poverty in their impact on food insecurity – and, if so, then to identify the impact of the interaction. Results displayed in Appendix 1 show a significant interaction, summarized in Tables 2 and 3 below. Further, the direction of the interaction runs counter to expectation -- providing important implications for research and policy.

Table 2 shows that the relationship of poverty to food insecurity is moderated by race. When going from low/unknown poverty to high poverty, the probability of food insecurity increases for both non-Whites and Whites. However, the magnitude of increase is different. Controlling for other relevant factors, for non-Whites the likelihood increases by 7.89% whereas for Whites it increases by 7.09%. The difference of 0.80% is

[30] It is important to note that data in this analysis is limited only to variables from the FSS due to challenges in obtaining the data in a limited amount of time. As discussed in the Literature Review, many other factors of food insecurity exist. Analysis using additional variables is left for future research.

not trivial – eighty basis points when applied to a population of millions of individuals makes for a difference of hundreds of thousands of people.

Table 2: Race moderates association between Poverty and Food Insecurity

Probability of Food Insecurity	Non-White	White
Low/Unknown Poverty	2.87%	1.67%
High Poverty	10.76%	8.76%
Difference	7.89%	7.09%

Notes: Race moderates the association between Poverty and Food Insecurity. On average, going from low/unknown poverty to high poverty, the probability of food increases more for non-Whites than it does for Whites, controlling for other factors. 'Unknown' poverty is shown in this summary table since the FSS data lump together 'Unknown/Low' poverty into one category. However, probit regression specifications in Appendix 1 use only the 'High' poverty observations to operationalize the Poverty variable. "Whites" includes only Non-Hispanic Whites only, "Non-Whites" includes all other races. Control variables: gender, age, marital status, living area (metropolitan or not), education level, and home ownership. Probabilities are calculated for a hypothetical 50-year-old, college-educated, married female with a spouse and an income below 185% of the poverty line (High Poverty), living in a metropolitan-area house that she or her spouse owns. Measures are statistically significant at the 99% significance level.

Table 3 displays probabilities of food insecurity using various assumptions, and provides a preliminary impact estimate of the observed interaction. As discussed further below, the relationship between race, poverty, and food insecurity is not simply one that can be understood intuitively; rather, it is a complex relationship with a statistically significant interaction between race and poverty that affects the degree to which food insecurity impacts non-Whites versus Whites.

Table 3: Impact of the Interaction between Race and High Poverty on Food Insecurity

	Interacted Model	Non-Interacted Model	Difference
Probability of Food Insecurity			
For Non-White	10.76%	11.50%	- 0.74%
For White	8.75%	8.55%	+0.21%

Notes: Overall, food insecurity is more probable for non-Whites: 10.76% compared to 8.76% for Whites. However, food security would have been 0.74% higher for non-Whites and 0.21% lower for Whites (depending on model assumptions) had it not been for the observed interaction between race and high poverty. Appendix 1 shows controlled probit regression specifications. "White" includes only Non-Hispanic Whites only, "Non-White" includes all other races. Control

variables: gender, age, marital status, living area (metropolitan or not), education level, and home ownership. Probabilities are calculated for a hypothetical 50-year-old, college-educated, married female with a spouse and an income below 185% of the poverty line (High Poverty), living in a metropolitan-area house that she or her spouse owns. Measures are statistically significant at the 99% significance level.

The key result obtained from this study is that race and poverty interact to create a significant and counter-to-expectation effect on food insecurity. Results in Table 3 (and corresponding specifications in Appendix 1) show that this interaction slightly mitigates the probability of food insecurity for Non-Whites but somewhat exacerbates the probability for Whites -- although the overall probability remains higher for non-Whites (10.76% for minorities vs 8.75% for Non-Hispanic Whites). Even after controlling for age, gender, education level, marital status, and home ownership/region, for non-Whites the coefficient on the interacted variable has a negative sign and is statistically significant at the 99% significance level (see Appendix 1). Overall, the interaction *lowers* the probability of food insecurity by 0.74% for Non-Whites but *increases* the probability by 0.21% for Whites when compared to estimates from a non-interacted model.[31] Although this difference appears to be small at first glance, in the context of food insecurity it is significant as it translates to hundreds of thousands of individuals (since the total population of food insecure Americans is in the tens of millions).

Results above are surprising because they run counter to intuitive expectations. Intuitively, one would expect that if – as all model specifications used in this analysis suggest – being in poverty and belonging to a racial minority is each associated with a

[31] Using this approach of comparing the interacted model's result to that from a non-interacted model shows the value of using interacted models to study food insecurity.

higher probability of food insecurity, then belonging to both of these groups would combine to almost always *increase* one's probability of food insecurity. However, as discussed above, while the overall likelihood of food insecurity remains higher for minorities, the *combination* of race and high poverty *slightly reduces* the probability for non-Whites on the whole and *slightly increases* it for Whites.

What could explain the surprising direction of this interaction? First, it is plausible that racial minorities might have stronger family and community bonds that may activate at times of need more quickly than those for Whites do. In times of financial hardship and strained resources for food, family members and friends may become an important source of food aid. It could be that in minority families, when an individual is experiencing hardship, other family members might come to aid with resources for food more readily. Second, it may be that racial minorities – already at an elevated risk of experiencing high poverty – might be more heavily targeted in outreach of food aid or other social support programs, resulting in higher awareness of resources to use in times of hardship. Finally, belonging to a racial minority in present-day America may be associated with slightly more grit and resilience, both of which are so critical for maintaining an effective life in the Trump era. Developing grit in one area of life can translate to grit in other aspects of life.[17] There is a possibility that having more grit overall can also somewhat affect one's perception/experience of food insecurity. It is common knowledge that racial minorities in the U.S. have been targeted at multiple times and places during recent years. Could it be that minorities have used this crucible to forge a tougher and more resilient response to setbacks like food insecurity in some

cases? Could it be that minorities, in response to facing widespread political threats, have banded together to help each other through tough times? While the results of this analysis cannot be uniformly applied to all racial minorities, on the whole they are significant nonetheless.

These results have at least three important implications. First, they suggest a potential bright spot in the food insecurity landscape for racial minorities and a hot spot for Whites. It may be possible to take something that works for minorities – such as family values and communal empathy – and foster it among people of all races in hopes of driving down overall food insecurity. Second, the results indicate that outreach and support efforts might need a fresh look to optimize the distribution of resources. While food aid programs should continue to be funded for racial minorities, perhaps resources can be offered in conjunction with efforts to increase communal empathy, which may help reduce food insecurity overall. Americans, on the whole, are relatively individualistic and prefer to lead independent lives – but in times of need, social and communal bonds may be a lifeline of help. Finally, these results open avenues for future research into what causes the interaction between race and high poverty in a counter-expected direction. Information can then be put into the hands of budget and policy makers – as well as administrators of food aid programs – to improve the net impact of resources spent on combatting food insecurity.

As a final note on the results of this paper, it is important to state that the Pseudo R^2 value is 17.3% in the interacted model. The fact that this model only explains about 17% of the variation in food insecurity lends support to the notion that there are

many more factors beyond the FSS data that can be incorporated in future research. By the same token, however, being able to explain almost a fifth of the variation by using just a handful of variables does tell us that the interacted model in this paper is a good starting point – and that, broadly, interacted models are the way forward in understanding the complexity of food insecurity.

5. Conclusion

This paper fills a gap in prior research by identifying an interactive effect of race and poverty on food insecurity. The results suggests that not only does a statistically significant interaction exist, but that its direction runs counter to expectation -- even after controlling for relevant covariates. Although racial minorities have a higher chance of being food insecure as compared to non-Hispanic Whites, nonetheless minorities (on the whole) experience a slight reduction in the probability of food insecurity while Whites experience a slight increase in probability as a result of this interaction. This observation runs counter to what one would intuitively expect. Result of this paper's analysis are preliminary, however, and further research is needed to understand the interaction more.

Although this study uses data from a large representative sample of Americans and results are statistically significant, there are some limitations to note. First, rural versus urban designation of a respondent's residence - an important factor of food insecurity identified in prior research - wasn't available for use in this analysis. Future research can join FSS data to larger datasets and expand the data used for this paper. Second, the FSS data are based on respondents' 12-month memory recall. It is possible

for an individual respondent's recollection to not always be reliable, causing potential measurement bias. However, the overall risk is likely low as the large number of respondents should help bring the sample means close to the true population means. Finally, while this analysis focuses on the U.S. population overall, it is important to note that it cannot be applied uniformly to all Americans. Although results are valid on average, important variations exist among different regions and demographics that must be accounted for via future research.

The findings of this analysis are important for a number of reasons. First, the results provide new insights into how food insecurity varies along demographic lines, helping identify a potential bright spot in the landscape of food insecurity that might slightly blunt the prevalence of hunger among minorities. If, as hypothesized, tighter community and family bonds among racial minorities slightly alleviate the impact of food insecurity then strengthening community bonds might be something to put more focus/resources on as part of government programs. Doing so would make for a more comprehensive framework of reducing hunger among people of all races. Second, results of this analysis add to the vast body of research that can better inform and improve federal spending on food aid. It is worthwhile to design federal outreach programs in a way that reflects an understanding of the interactive effects between race and socioeconomic status. Such designs can make for more effective and budget-friendly food aid programs that might draw support from both sides of the isle in a divided government. Third, results from this study open up avenues for further research. One logical next-step is to breakdown the non-White variable into specific

race variables of their own and re-run the analysis for each race. That approach will more granularly identify how race and high poverty levels interact. It is certainly likely that for some minorities the interaction is as-expected while for others it runs counter to expectation – and that it has sizably different magnitudes by race. Further, comparisons of probabilities using more intricate mathematical assumptions – such as using a model with a reversed direction of the interaction[32] – might show a significantly greater difference vs non-interacted models. Finally, if with further research the interaction above is tied to how outreach of food aid programs is conducted, then one can argue that outreach to minorities might be working as intended. In that case, recommendations can be made for policies/budgets to continue prioritizing these programs – and for comprehensively expanding outreach to reduce hunger across all races.

The importance of food insecurity and understanding its factors cannot be overstated. Human civilization transpired out of a need to secure basic needs of life for all. Yet, ongoing politicized debates over public funding to feed the hungry are among the clearest examples of a struggle between fairness and injustice that weaves the fabric of human history. The fact that more than a tenth of the population of the world's richest country - in the 21st century - cannot get adequate food is both alarming and, in light of a tumultuous history, not surprising. The climate of racial, political, moral, and social undercurrents sweeping across the United States and beyond is starkly evident

[32] This was left out of the paper since it requires diving further into the mathematical intricacies of regression models. In future research, the analysis in this paper can be replicated with more combinations of assumptions.

today – and food security is of critical importance in that context. This paper offers a small but important contribution to research that can eventually improve how government cares for the vulnerable among us – and, in the words of Lincoln, do so "with malice toward none, with charity for all, [and] with firmness in the right as God gives us to see the right".[33]

[33] Abraham Lincoln, "The Second Inaugural Address of President Abraham Lincoln, Washington, D.C., March 4, 1865," Presidential Addresses and Messages, Lit2Go Edition, (1865), accessed August 10, 2020, https://etc.usf.edu/lit2go/132/presidential-addresses-and-messages/5161/the-second-inaugural-address-of-president-abraham-lincoln-washington-dc-march-4-1865/

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7. Appendix 1

As Table A shows below, food insecurity is significantly impacted by the specified independent variables, including the interacted term. Differences in probabilities are summarized in Tables 2 and 3 (Results section).

Table A: Specifications of Probit Models for Food Insecurity

Independent Variables	**Model 1 (Non-White)**	**Model 2 (Non-White)**	**Model 3 (Non-White)**	**Model 4 (Non-White)**
Race (See Model Labels)	0.367*** (0.020)	-	0.169*** (0.023)	0.226*** (0.032)
High poverty	-	0.990*** (0.018)	0.746*** (0.020)	0.771*** (0.023)
Race x High poverty (Interacted)	-	-	-	**-0.110**** (0.045)
Gender (Female)	-	-	0.168*** (0.019)	0.168*** (0.019)
Age	-	-	-0.006*** (0.001)	-0.005*** (0.001)
Metropolitan Residence	-	-	-0.041* (0.023)	-0.041* (0.023)
College Degree	-	-	-0.471*** (0.024)	-0.472*** (0.024)
Married with Spouse	-	-	-0.260*** (0.210)	-0.259*** (0.021)
Home Ownership	-	-	-0.346*** (0.022)	-0.345*** (0.021)
Constant	-1.27*** (0.010)	-1.59*** (0.012)	-0.866*** (0.039)	-0.877*** (0.039)
Probability of Insecurity (Non-White)	18.2%	27.2%	11.5%	10.76%
Pseudo R^2	0.0117	0.114	0.172	0.173
n	37,304	37,304	36,958	36,958

Notes: Race = 1 for "Non-White" (all races other than non-Hispanic Whites only) and 0 for all others. *Food Insecurity* is the dependent binary variable. *Race*, *High Poverty*, and *Race x High Poverty* are the independent variables of interest. Models 1 and 2 present uncontrolled results. Models 3 and 4 present controlled results in which *Probability* calculated is for a hypothetical 50-year-old, college-educated, married female with a spouse and an income below 185% of the poverty line, living in a metropolitan area house that she or her spouse owns. Robust standard errors are given in parentheses under regression coefficients. * $p < .1$, ** $p < .05$, *** $p < .01$.

8. Curriculum Vitae Summary

AHMED KHAN IS A CANDIDATE FOR A MASTER OF SCIENCE DEGREE IN GOVERNMENT ANALYTICS WITH A CONCENTRATION IN STATISTICAL ANALYSIS AT THE JOHNS HOPKINS UNIVERSITY. HE HOLDS A BACHELOR OF ARTS DEGREE WITH HONORS IN POLITICAL SCIENCES FROM THE UNIVERSITY OF CALIFORNIA, IRVINE. AHMED'S UNDERGRADUATE EDUCATION FOCUSED ON POLITICAL BEHAVIOR, QUANTITATIVE ANALYSIS AND DEMOCRATIZATION. HE IS PASSIONATE ABOUT NON-PROFIT, GOVERNMENT, AND PRIVATE SECTOR PROGRAMS AIMED AT ENRICHING LIVES EQUITABLY. AHMED IS HIGHLY SKILLED AT BRINGING TOGETHER DATA AND PEOPLE TO DELIVER MEANINGFUL RESULTS. HE CURRENTLY SERVES AS A SENIOR MANAGER OF ANALYTICS AT AT&T, CREATING DATA-DRIVEN SOLUTIONS TO KEEP CUSTOMERS CONNECTED WITH THEIR WORLD.